

# **DIDSON MONITORING AND FISH RESCUE IN THE COLUSA BASIN DRAIN**

## **- STUDY PLAN -**

### **1.0 Background Information**

The Colusa Basin Drain (CBD) is a man-made structure that drains runoff and irrigation return flows from approximately one million acres (1,620 square miles) of public and private lands within Glenn, Colusa, and northern Yolo counties. The CBD conveys water to the Knights Landing Outfall Gates (KLOG) which helps to regulate the amount of water flowing out to the Sacramento River or down the Knights Landing Ridge Cut. Water that enters the Knights Landing Ridge Cut flows into the Yolo Bypass (bypass).

In April 2013, U.S. Fish and Wildlife Service (USFWS) personnel at the Sacramento National Wildlife Refuge reported seeing a large number of adult salmon trapped behind a diversion in North Logan Creek in the refuge. California Department of Fish and Wildlife (Department) personnel verified the observation of Chinook salmon. Rescue operations were then carried out in North Logan Creek and surrounding canals during April and May 2013. A total of 312 winter-run and spring-run Chinook salmon were rescued and transported back to the Sacramento River or taken to Livingston Stone National Fish Hatchery. Hundreds of additional Chinook salmon were sighted, but could not be recovered; consequently it is unknown how many fish were entrained into the CBD and subsequently perished. Although winter-run and spring-run Chinook salmon are of particular interest due to their listed status, other races of salmon and anadromous species such as green and white sturgeon, and steelhead have the potential to be entrained in the CBD and may require rescue.

In order to capture salmon and sturgeon prior to their entry into the CBD, the Department operates a fyke trap at Wallace Weir. Another trapping site location was selected within the CBD and an Alaskan style resistance board weir and fish trap was developed for use to capture fish once they have entered the CBD. These two sites act as the primary locations where the Department will focus efforts to capture wayward fish in the CBD (Figure 1).

### **2.0 Study Objective**

It is suspected that not all of the wayward fish that enter the CBD are collected by the trapping gear at the Wallace Weir fyke and CBD fish weir trapping locations. Fish that are not captured at these two locations need to be found, enumerated, captured and relocated to the Sacramento River. To address this issue, the Department has developed a monitoring plan where Department staff will utilize a Dual-Frequency Identification Sonar (DIDSON) camera to locate

salmon and sturgeon and identify their holding areas within the CBD and associated tributaries. This will allow the Department to capture and relocate species of interest.

**Primary goals of this project include:** (1) Identify areas where fish may congregate once they have entered the CBD; (2) Detect and enumerate the presence of focal species within the CBD using sonar imagery; (3) Minimize the losses of salmonids and sturgeon in the CBD through rescue; (4) Examine the timing, size, and species composition of entrained fish in conjunction with data on water temperature and flow. This data will be used by the Department in combination with the Wallace Weir fyke trap and CBD resistance board weir operations to evaluate if operational and or environmental conditions result in increased levels of entrainment in the CBD. The Department's policy on fish rescues has been included in Appendix A.

### 3.0 Focal Species

- Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*); federally and state listed threatened species.
- Sacramento River winter-run Chinook salmon (*O. tshawytscha*); federally and state listed endangered species.
- California Central Valley steelhead (*O. mykiss*); federally listed threatened species.
- North American green sturgeon, Southern distinct population segment (*Acipenser medirostris*); federally listed threatened species.
- White sturgeon (*A. transmontanus*); sport fish with special regulations.

### 4.0 Using Sonar Imagery to Find Stranded Fish

Primary efforts to capture fish prior to entry or once entered into the CBD will be focused at the Wallace Weir fyke trap and CBD resistance board weir trapping locations. Operations are limited at these two locations by flows in the CBD; when flows are too great, both sites can become compromised, allowing fish passage. When fish passage is thought to occur, the Department will initiate a roving survey using DIDSON sonar imagery at known choke points within the CBD and associated tributaries to look for focal species. Once focal species have been identified to be present at any one location in the CBD, the Department will focus efforts to capture and then relocate wayward fish to the Sacramento River. Sonar imagery will help to identify substrate complexity, species presence/absence, and potential capture equipment needed for a rescue. Sonar imagery will also be helpful in identifying underwater hazards that may foul capture gear or be dangerous for Department personnel to work near.

A DIDSON 300 unit with a 60 meter cord will be used for these purposes. The video quality of this unit allows for images of fish and substrate characteristics in turbid water bodies. The unit has a 30 meter viewing range, critical for making observations in many of the choke points in the CBD where fish may congregate. The DIDSON unit will be attached to an aluminum staff and by hand, field staff will deploy the unit at each monitoring location.

The DIDSON unit and laptop will be powered by a Honda 2000 generator. Field staff will ensure that the generator has gas and a back-up 5 gallon tank of gas is available at all times.

DIDSON sonar images will be read in real-time by field staff as images are being acquired and recorded to an associated field laptop hard drive. DIDSON image files from each site will be transferred to a dedicated electronic storage file in the R2 office when staff returns from the field. Downloaded videos will be reviewed at the office the same day they were recorded to ensure presence or absence of focal species at sampling locations. Each DIDSON image file will be titled with standardized nomenclature (the site ID, the date and video sequence number (01, 02, 03, etc.)). For instance, a tissue gathered from site 10 on January 28<sup>th</sup> 2015, would have the video file labeled as: "site\_10\_1-28-2015\_video\_01" followed by "site\_10\_1-28-2015\_video\_02".

DIDSON image files will be stored at the office in the following location:

U:\241-FISHERIES\Colusa Basin Drain Fish Monitoring\Didson\Didson Sites

If a focal species is observed while in the field or upon review of DIDSON video while at the office, field staff will immediately inform project leads who will initiate rescue operations (see Section 8.0 for project lead information or Appendix B for staff contacts).

## **5.0 Monitoring Locations**

In order to find focal species that have passed the fyke at Wallace Weir and the resistance board weir in the CBD, several monitoring locations within the CBD will be identified and visited with some frequency. Secondary sites will also be established and visited on an as-needed basis. All primary and secondary monitored sites will be established ahead of time and evaluated for their individual importance based on historical knowledge (where we have seen focal species in the past) as well as real-time information (where we are currently seeing fish).

### **5.1 Primary Locations**

Primary locations are familiar to Department staff in that focal species have been observed historically, and are areas where the Department has performed fish rescues in the past; thus having higher priority in regard to frequency in which they are visited by staff. These sites will be visited on a weekly basis. These locations tend to be near water management structures (e.g. head dams) and are near roads and have easy access to the water body. Several of these sites may be visited in one day. These locations are listed in Table 1 and described in Figures 2.1 through 2.8.

Waypoint	Latitude (°N)	Longitude (°W)	Waypoint	Latitude (°N)	Longitude (°W)
Site 1	38°47'58.03"N	121°43'31.15"W	Site 15	39°11'16.29"N	122° 3'27.86"W
Site 2	38°48'44.83"N	121°46'27.37"W	Site 16	39°13'0.69"N	122° 5'14.81"W
Site 3	38°55'30.87"N	121°54'53.00"W	Site 17	39°14'47.40"N	122° 5'28.50"W
Site 4	38°58'8.65"N	121°55'35.52"W	Site 18	39°16'30.91"N	122° 5'11.16"W
Site 5	39° 0'45.95"N	121°58'50.88"W	Site 19	39°16'29.59"N	122° 6'16.14"W
Site 6	39° 3'22.52"N	122° 0'12.83"W	Site 20	39°18'3.73"N	122° 8'6.56"W
Site 7	39° 6'51.68"N	122° 1'5.43"W	Site 21	39°18'6.97"N	122°10'4.82"W
Site 8	39° 6'53.12"N	122° 1'21.03"W	Site 22	39°20'31.13"N	122° 5'39.76"W
Site 9	39° 6'53.45"N	122° 2'14.18"W	Site 23	39°20'28.79"N	122° 5'4.55"W
Site 10	39° 6'54.98"N	122° 3'42.23"W	Site 24	39°21'54.90"N	122° 6'57.26"W
Site 11	39° 6'54.59"N	122° 4'42.25"W	Site 25	39°24'26.40"N	122° 8'39.54"W
Site 12	39° 7'22.54"N	122° 5'2.19"W	Site 26	39°26'11.25"N	122° 9'44.53"W
Site 13	39° 8'40.25"N	122° 1'36.90"W	Site 27	39°19'42.87"N	122°13'45.87"W
Site 14	39°10'59.15"N	122° 3'4.95"W	Site 28	39°19'50.60"N	122°17'17.10"W

**Table 1.** A list of the 28 primary observation sites and their associated waypoint coordinates (recoded in degrees, minutes, seconds).

## 5.2 Secondary Locations

Secondary locations are those where the Department may only have anecdotal evidence of focal species presence warranting infrequent site visits. Real time review of flows in the CBD may provide theoretical potential for focal species presence warranting special, one-time visits. A secondary location may become a primary location based on continued focal species presence.

Flows in the CBD are largely unpredictable, meaning that at any one time, flows may be optimal to attract fish to another, previously unknown area in the CBD. Alternatively, when a suspected congregation site in the CBD receives sub-optimal flows, a site may be determined uninhabitable for fish and receive less monitoring effort.

## 6.0 Release Locations

All focal fish species captured in the CBD or associated tributaries will be transported and released into the Sacramento River. The primary location for fish to be released is at Elkhorn Boat Ramp which is below the confluence of the Sacramento and Feather rivers. This location is available during variable river flows and allows Department staff to release fish from transport trailers using the boat launch ramp.

Secondary release sites are evaluated as needed. New release sites may need to be established in regard to their close proximity to capture locations. The Tisdale and Butte City boat ramps may be favorable release locations due to their close proximity to the northern sampling sites.

## 6.1 Transport Equipment

The program uses two 400 gallon transport tanks mounted on trailers to move fish from a capture location to a release location. The tanks are outfitted with their own power source that operates water circulators and aerators inside of the tank. The tanks are outfitted with pure oxygen cylinders which are used to supply fish with fresh oxygen during transport. Each tank can hold approximately 12 adult salmon.

River access for these transport trailers is important; the trailers need to be backed down a boat launch in order to release fish from the tank to the river. The tanks have adult salmon sized flap gates that are pulled in order to let salmon volitionally swim out of the tank to the river. Tanks with this style of flap gate allow for significantly less handling stress compared to other transport tank options.

Prior to releasing fish from a transport tank to the river, water temperature in the tank and river are evaluated. If there is a 2 degree (Fahrenheit) or greater difference between the water temperature of the tank and river, river water will be added to the tank to acclimatize fish prior to release.

Green and white sturgeon will be transported in a specially designed sturgeon transport tank. This tank is fitted to be carried in a long bed truck and has a lid that ensures secure transport of even the largest sturgeon. The sturgeon tank has external, battery operated aerators; extra batteries will be carried with this tank at all times. Water temperature of the sturgeon transport tank and release site will be evaluated similar to the salmon transport tank; sturgeon will be acclimatized prior to release.

The program employs the use of sturgeon and salmon cradles when carrying fish by hand. This is useful when moving a fish from a water body to a transport tank. Each style of cradle is designed to allow one or two staff to carry one fish at a time, safely so the fish does not fall onto the ground.

## 7.0 Sampling Frequency

Primary locations will be visited on a weekly basis. Secondary locations will be visited on a less frequent basis. If focal species presence becomes more significant at secondary sites, the frequency in which the sites are evaluated will be adjusted accordingly. At every sampling site visit, observation notes, environmental information (water temperature, turbidity and flow rate), and DIDSON video will be recorded.

## 8.0 Concurrent Monitoring

There are several concurrent monitoring efforts in the bypass and other nearby water bodies. Observations of focal species at these other monitoring sites will be an indicator of the potential of focal species presence in the CBD. Information supplied by concurrent monitoring efforts will be evaluated by the Department which will help in directing sonar tracking efforts within the CBD. Also, documented river flows at nearby sites can be used as an indicator of timeframes when focal species have the potential to enter the CBD. Concurrent nearby fishery or river flow monitoring efforts include;

A) CDWR is currently operating a fyke trap near Lisbon Weir in the toe drain of the bypass. The Lisbon Weir is downstream from the Wallace Weir sampling location. These efforts may provide

information that could be used as an early warning of potential for fish presence in the CBD and aid in refining our understanding of entry points into the CBD.

B) Operational changes at the KLOG may allow focal species to enter the CBD during high flow events in the Sacramento River. Fish passage opportunities based on operational conditions at KLOG were evaluated by the Department after the spring 2013 rescue efforts. It was shown that conditions were conducive to fish passage on a number of occasions during the spring. (See Appendix C for work conducted by George Heise).

C) The Wallace Weir fyke trapping operation run by the Department will help predict when focal species are trying to enter the CBD by way of the Ridge Cut Slough (The CBD flows into the Ridge Cut near the town of Knights Landing).

D) California Data Exchange Center (CDEC) operated by CDWR provides up-to-date, by the hour estimates on flows in the Sacramento River as well as some locations in the CBD. These values can be helpful in understanding where there is enough water to hold fish or areas where fish may be attracted once in the CBD.

## **9.0 Sampling Procedures and Protocols**

It is the responsibility of all Department staff involved with this monitoring plan to read and understand what has been supplied in this document. All staff involved in this project will review these documents to ensure adherence to rules and regulations set forth.

### **9.1 Coordination Activities**

Required permits and access agreements will be obtained prior to the commencement of trapping and handling of fish including flood board agreements, federal take permits, and local water district access agreements. Necessary permits and access agreements are not limited to, but are as follows;

A) Federal Take permit 18181, issued to the Department from the National Marine Fisheries Service allows for the handling and transport of endangered and threatened focal fish species in regard to fish rescue (Appendix D). Primary contact at NMFS: Amanda Cranford (916) 930-3706.

B) Written permission given to the Department by the US Fish and Wildlife Service to access locations within the Sacramento, Delevan and Colusa National Wildlife Refuges. Contact for Sacramento National Wildlife Refuge Complex: Chris Barr (530) 934-2801.

C) Road access agreement provided to the Department by Reclamation District 108. Project leads will coordinate with RD 108 for attaining gate keys and will provide a list of anticipated staff working on the project. Primary contact with RD 108: Chad Navarrot (530) 870-1213.

### **9.2 Site Sampling and Environmental Data**

Before leaving the office, field staff will review the monthly schedule to determine the on-call project lead (see staff information in Section 10.0) as well as the equipment check list to ensure all needed equipment has been packed (Appendix E). For the safety of the crew, when staff



first arrives at any one sampling location, they will look around for signs of illegal activities like poaching. If any suspicious activities are noticed, staff will take detailed notes and pictures to document. If illegal activities are occurring, 911 should be called if there is immediate danger. Additional support can be provided by CDFW Warden Lieutenant Samuel P. Castillo: (cell 530-895-4240). Field staff can also call the on-call project lead if additional assistance is needed.

If the sampling area is secure, staff will begin by assessing if there are any focal species at the site visually. Often salmon or sturgeon can be observed by eye, prior to physically entering the water to use the DIDSON. Salmon also tend to porpoise or breach the water surface while they mill about. Direct observational surveys will be conducted near the water body 250 yards upstream and downstream. These notes will be recorded at each site, prior to using the DIDSON unit.

Once it is time to use the DIDSON, one person will enter the water body near shore and start using the unit, while another person will stay on shore reading the associated sonar imagery on a laptop. The person using the laptop will relay fish observations and direct the person in the water using the DIDSON. In this fashion, the two staff will use the DIDSON camera to work the water body until all underwater areas have been observed and recorded.

If focal species are identified at the site, staff will attempt to gage the number, species composition, and condition of fish. This information will be recorded on field data sheets. At this time, field staff will call the on-call project lead to report the situation and get further instructions.

It is important that fish observations, both by eye and with DIDSON, are made prior to gathering environmental data, as this allows the project lead to expedite rescue procedures if a focal species is observed. Environmental data that will be collected includes water temperature, flow rate and turbidity. Temperature data will be collected at each site using standard, hand held thermometers. If project management deems it necessary, thermographs (HOBO units) will be launched at specific or all of the sampling locations. If deployed, thermographs will be downloaded on a routine basis and removed when no water is flowing in the CBD. Turbidity and water flow rate will be collected whenever a DIDSON is used. These values may be indicators of the likeliness of certain species holding in specific areas in the CBD which will be helpful in refining future searching efforts.

The following data will be recorded on a mobile tracking datasheet:

1. Date
2. Mode of tracking (e.g. by eye from shore, DIDSON, snorkel)
3. Start time and end time of survey
4. Number of trackers and initials of each
5. Weather
6. Location surveyed (Gather a waypoint using GPS)
7. Water turbidity
8. Water transparency
9. Water temperature
10. Fish observations

All data from site visit will be recorded on daily datasheets (Appendix F).

### 9.3 Fish Data

Biological data (fork length, sex, physical condition, ad-clip status, tissue samples for genetic analysis, and presence of any mark or external tags) will be collected for all salmonids during capture and relocation efforts. Tissue samples for genetic analysis will be collected from all Chinook salmon and be labeled and preserved using standard techniques as described in Section 9.4 and Appendix G. Each rescued Chinook salmon will receive an external individually-numbered Floy tag prior to transport and release to the Sacramento River. The Floy tags are printed with Region 2 phone number (916) 358-2900.

Sturgeon will be similarly processed for biological data, tissue collection for genetic analysis and external tags; however external disc tags will be utilized rather than Floy tags. Based on the direction of Department senior management, some sturgeon will receive an internally planted V13 Vemco acoustic tag in order for the Department to track movements after release. To aid in sturgeon identification, additional data including presence or absence of barbels, presence or absence of scutes, the number of lateral scutes (if any), and presence or absence of lateral stripes between the lateral and ventral scutes will be collected.

### 9.4 Genetic Sampling

Tissue samples for genetic analysis will be collected from every salmon using standard techniques. When large numbers of Chinook salmon are encountered a subsampling of fish may be employed, if deemed necessary by project leads. Samples will be collected on a systematic subsample of fish. Tissue samples will be collected following the Department's air dried protocol as described in Appendix G. All samples will be taken from the caudle fin when possible and will be labeled with a unique individual ID (the site ID, the date plus a unique number (01, 02, 03, etc.)). For instance, a tissue gathered from Funk Creek on January 28<sup>th</sup>, 2015 would have the number: FC 1 28 15 0001, followed by FC 1 28 15 0002. All tissues will be transferred to the CDFW Tissue Archive in Sacramento (see Appendix G for tissue collection protocol).



## **10.0 Program Staff**

### **Anadromous Fisheries Program Lead:**

Colin Purdy, 916-704-2154

### **Project Lead Staff:**

Chris McKibbin, 916-202-9325

Clint Garmin, 530-333-7748

Mike Healey, 916-747-1757

### **Back-up Project Lead Staff:**

Kevin Thomas, 916-817-9467

Tom Schroyer, 916-445-0008

### **Screen Shop Support:**

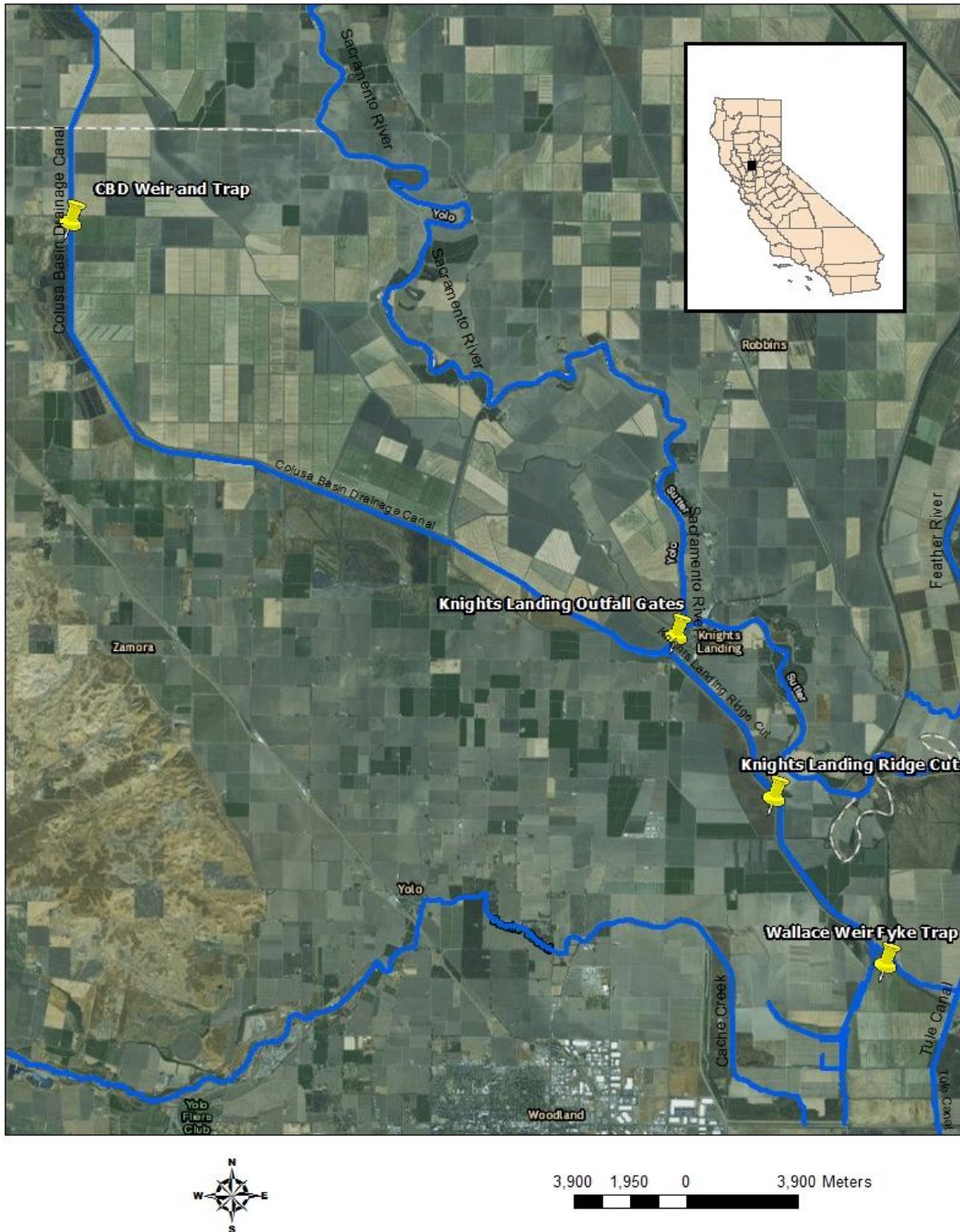
Greg Whitaker, 916-261-3902

Philip Clark, 916-718-2201

### **Field Staff:**

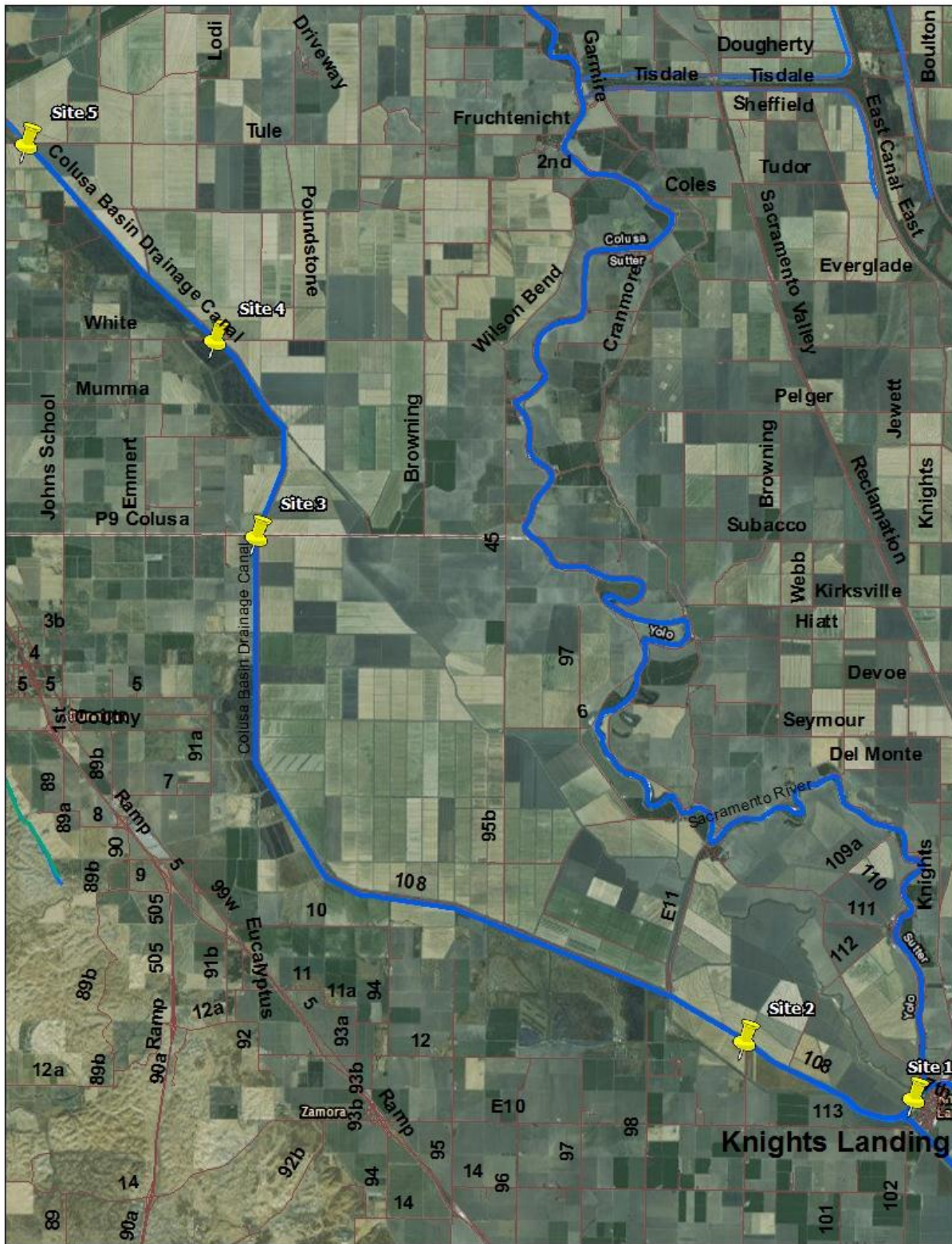
See attached contact sheet (Appendix B)

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**Figure 1:** Map showing the Colusa Basin Drain weir and trap, Knights Landing Outfall Gates (KLOG), Knights Landing Ridge Cut and Wallace Weir fyke trap location.





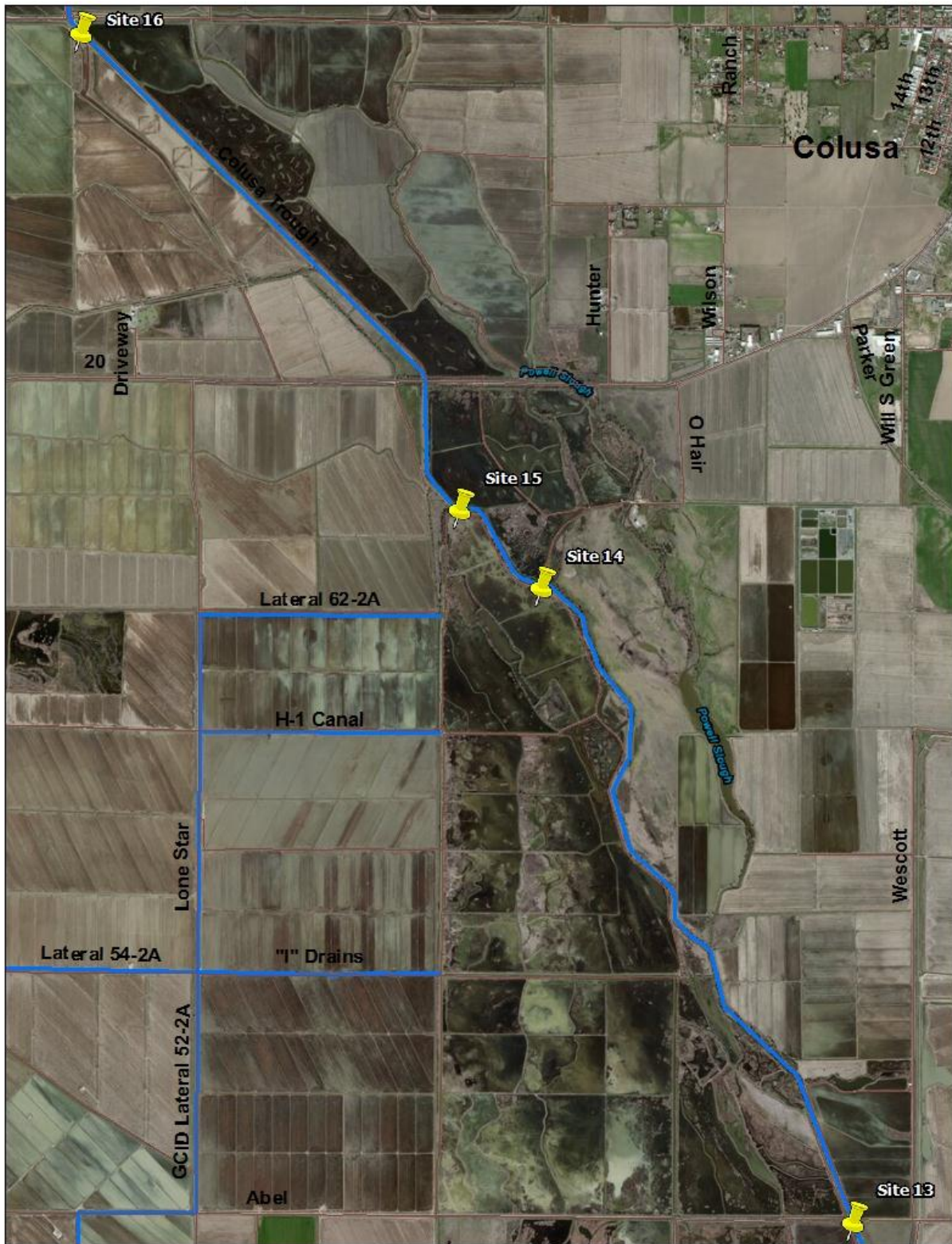
**Figure 2.1:** Map showing primary locations to make observations with DIDSON in the Coulusa Basin Drain Canal near the town of Knights Landing, California.





**Figure 2.2:** Map showing primary locations to make observations with DIDSON in the Colusa Basin Drain Canal near the Colusa National Refuge, California.





**Figure 2.3:** Map showing primary locations to make observations with DIDSON in the Colusa Basin Drain Canal near the town of Colusa, California.



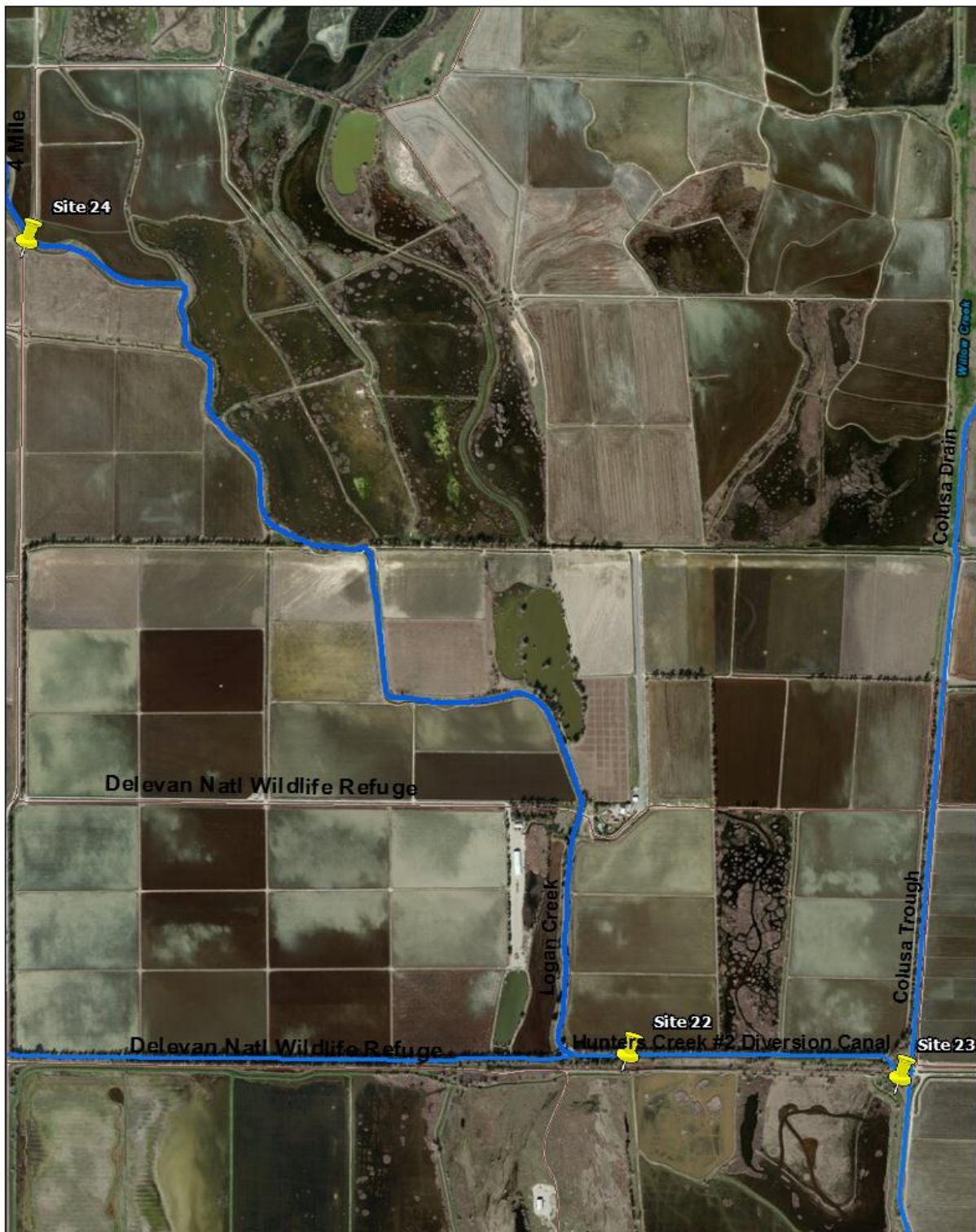


**Figure 2.4:** Map showing primary locations to make observations with DIDSON in the Coulusa Basin Drain Canal and Stone Corral Creek south of Delevan National Refuge, California.





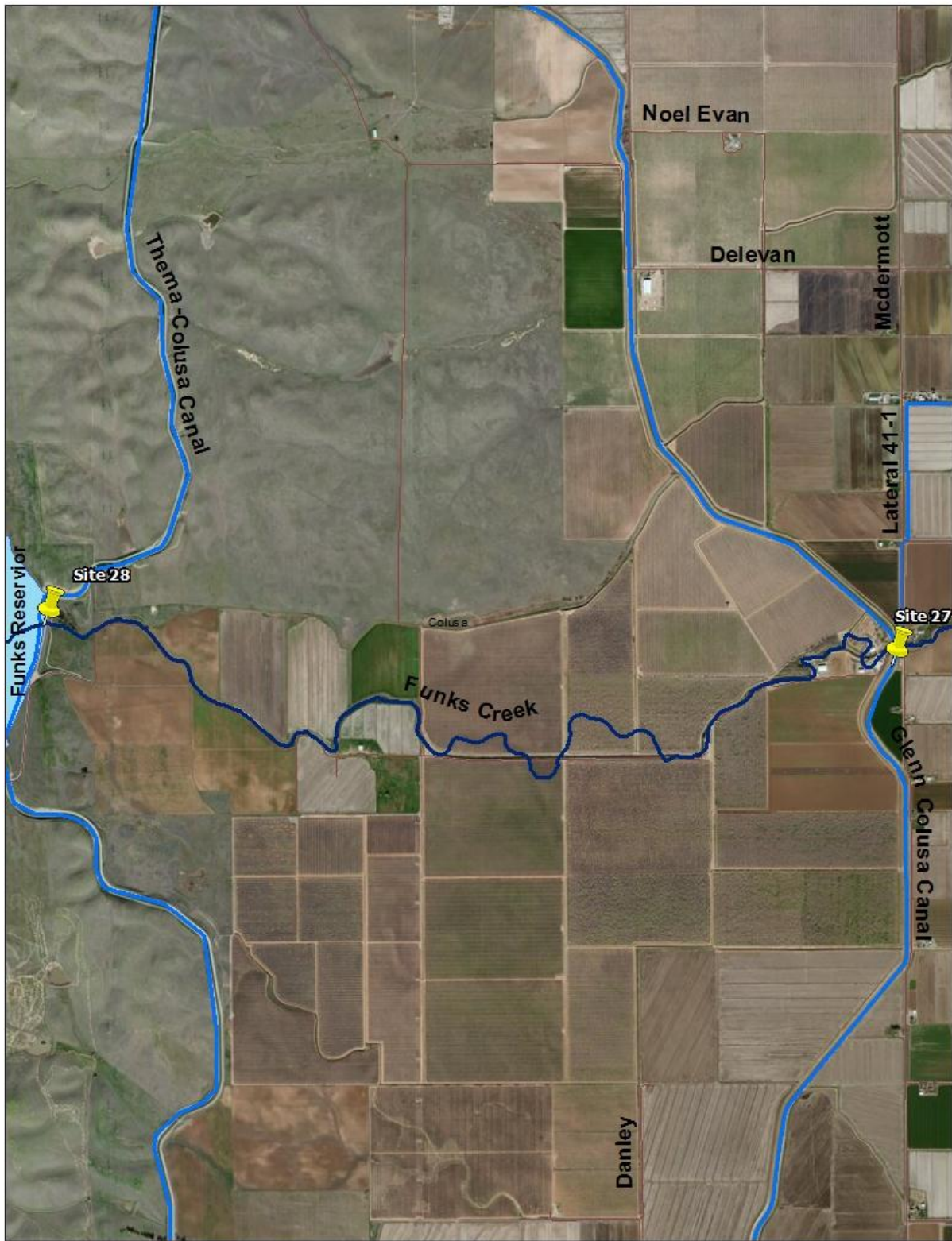
**Figure 2.5:** Map showing primary locations to make observations with DIDSON in Stone Corral Creek west of Delevan Natlinal Refuge, California.



**Figure 2.6:** Map showing primary locations to make observations with DIDSON in the Colusa Basin Drain Canal and Logan Creek near the Delevan National Refuge, California.







**Figure 2.7:** Map showing primary locations to make observations with DIDSON in North Fork Logan Creek near the Sacramento National Refuge, California.

**Figure 2.8:** Map showing primary locations to make observations with DIDSON in Funks Creek below Funks Reservoir, California.

**Appendix A.** Department Fish Rescue Policy

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To: Department of Fish and Wildlife Staff

Subject: POLICY AND PROCEDURAL GUIDANCE FOR FISH RESCUE

## BACKGROUND

Fish Rescue is defined by the Department as an action taken to remove finfish<sup>1</sup> from habitat which is or will soon become unsuitable and relocating those fish either to more suitable habitat, an interim holding facility or a permanent artificial environment. These events are often predictable and a procedure is needed to determine what fish rescue response is warranted, if any, for a particular habitat. This policy and procedure applies to unique events and also as a programmatic approach where fish rescue opportunities will reoccur. This policy and procedure does not apply to actions taken to minimize entrainment or salvage fish as part of the State Water Project, Federal Central Valley Project, or other existing projects where fish salvage is an adopted operational procedure.

The Department signed an interagency agreement in 2009, with the U.S. Fish and Wildlife Service and National Marine Fisheries Service, defining roles and responsibilities for fish rescue of anadromous species listed under both the Federal and State endangered species acts. That agreement expired after 2010 and the Department is currently negotiating a new agreement with the Federal agencies. The Department will follow the procedures specified in this policy when implementing its responsibilities under any new agreement with Federal agencies.

Existing Fish and Game Code (FGC) and Fish and Game Commission (Commission) policies and authorities apply to this practice. Principally, these are:

1. FGC §1001;
2. FGC §1700; and
3. Commission Policies
  - a) Anadromous Rainbow Trout (Steelhead)
  - b) Salmon.

FGC §1001 authorizes the Department to take fish for scientific, propagation, public health or safety, prevention or relief of suffering or law enforcement purposes.

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<sup>1</sup> Finfish are defined as any species of bony fish or cartilaginous fish (sharks, skates and rays). Finfish do not include amphibians, invertebrates, plants or algae. 14 CCR § 1.46



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FGC §1700 establishes the objectives of maintaining sufficient populations of aquatic organisms to insure their continued existence and maintenance of fishery resources for reasonable sport use and local commercial fisheries. Notably, it does not advocate expending Department resources for actions with little or no benefit for fish populations.

Commission policies for salmon and steelhead include guidance as to when these species should or should not be rescued. Fish rescue is not referred to in other Commission policies, the FGC or Title 14 of the California Code of Regulations.

The Department lacks independent authority to authorize fish rescue by private parties. In many cases such action would require approval by a Federal agency and/or the Commission to resolve conflicts with bag limits, seasons, methods of take, possession and moving live fish.

## PROCEDURE

Each fish rescue decision shall be based on the best available information and will include a written assessment by the appropriate Regional Manager of the answers to the following questions.

1. Approximately how many fish of different species and age classes are likely to die if a fish rescue is not implemented?
2. Are the subject fish listed as Threatened or Endangered?
3. Is the potential fish rescue an important action necessary to maintain sufficient populations to ensure the species' continued existence or maintenance of fishery resources for reasonable sport use and commercial fisheries?
4. Is the receiving location in the same watershed and ordinarily accessible by the fish considered for rescue?
5. Is there any risk of disease or invasive species contamination if the fish rescue proceeds?
6. What adverse impacts are reasonably foreseeable for existing native fish populations in the receiving location?
7. What substantial evidence suggests that rescued fish will survive in the receiving habitat?
8. Will the Department or other entity monitor the fate of the rescued fish and determine any effects on the receiving habitat, including other fish populations?
9. Will the safety risks related to the fish rescue exceed the normal duty parameters of the personnel conducting the activity?
10. Are there sufficient Department staff available to conduct a fish rescue and is their base funding appropriate to this work?
11. What activities will not be accomplished due to staff redirections if the fish rescue is implemented?
12. Considering location, access, timing, available equipment, costs and staff, and any other relevant factors, is fish rescue feasible?
13. Are other habitat remedies available (e.g. additional upstream flow releases)?

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14. Are the unsuitable habitat conditions created by a violation of State or Federal law?
15. Is there a party that is willing or responsible to fund fish rescue?
16. Has any required consultation with National Marine Fisheries Service or Fish and Wildlife Service been accomplished?
17. Have all necessary approvals by other entities been obtained?
18. If fish are not rescued, what enforcement resources and activities will be impacted should the site need to be monitored?
19. If the fish are not rescued, what impact will this have on communication education and outreach resources?

Based on the information derived from this assessment the Regional Manager will exercise his or her judgment and determine if the probable benefits of fish rescue are reasonable when balanced against other factors.

Decision authority for implementing fish rescues resides with the Regional Manager following consultation with the Fisheries Branch Chief, the Office of Communications Education and Outreach and Assistant Chief of Enforcement for the affected district. The Office of General Counsel shall be consulted before authorizing volunteers to conduct fish rescue. Where invasive species or disease risks are possible, or the Department is considering moving rescued fish to a location which is not ordinarily accessible to the subject fish, Department fish pathologists and aquatic invasive species staff shall be consulted. The Regional Manager will consider recommendations of the above parties before reaching a decision.

The Regional Manager will document their decision in a memorandum to the Deputy Director of Wildlife and Fisheries Division, Deputy Director of Law Enforcement Division, Deputy Director of Communications, Executive Director of the Fish and Commission and other parties previously consulted. If the decision is to proceed with the fish rescue, the Regional Manager will then implement the fish rescue. Within 30 calendar days of completing the fish rescue, the Regional Manager will report to the above parties on the procedures and results of the fish rescue and any further plans for monitoring.

The Department may condone fish rescue actions conducted mainly by private parties when the following conditions are satisfied:

1. Department staff are present, and
2. Individuals conducting the activities are registered as volunteers with the Department, and
3. The fish rescue activities comply with existing statutes and regulations.

The Department will review opportunities to update existing regulations (e.g. 14 CCR §1.87) to allow the Department to exercise reasonable site specific discretion in regulating the take of stranded fish.

## POLICY STATEMENT

The California Department of Fish and Wildlife will only rescue finfish when an objective evaluation of the available information strongly supports a determination that the actions will be consistent with other existing policies, will be an important contribution to conservation of fish populations, is a reasonable use of Department resources and can be safely and effectively accomplished. Decision authority for fish rescue resides with the appropriate Regional Manager after following specified procedures.



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Charlton H. Bonham  
Director

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## **Appendix B: Staff contact information**

### **PERMANENT STAFF**

Colin Purdy – office: (916) 358-2943, cell: (916) 704-2154 colin.purdy@wildlife.ca.gov  
Chris Bennett (Upper Butte Basin Screen Shop) – cell: (530) 624-0150 chris.bennett@wildlife.ca.gov  
Mike Healey – office: (916) 358-4334, cell: (916) 747-1757 mike.healey@wildlife.ca.gov  
Diane Coulon – office: (530) 895-5002, cell: (530) 333-7747 diane.coulon@wildlife.ca.gov  
Clint Garman - office: (530) 895-5110 (530) 333-7748 clint.garman@wildlife.ca.gov  
Chris McKibbin – office: (916) 358-2932, cell: (916) 202-9325 chris.mckibbin@wildlife.ca.gov  
Jeanine Phillips - office: (916) 358-2030, cell: (916) 215-2152 jeanine.phillips@wildlife.ca.gov  
Jason Julianne – office: (916) 358-2832, cell: (916) 496-4985 jason.julianne@wildlife.ca.gov  
Tom Schroyer – office: (916) 916-445-0008 tom.schroyer@wildlife.ca.gov  
Greg Whitaker – office: (530) 757-8412, cell: (916) 261-3902 greg.whitaker@wildlife.ca.gov  
Philip Clark – office: (530) 757-8412, Cell: 916-718-2201 philip.clark@wildlife.ca.gov  
- fax at the Yolo Screen Shop: (530) 757-8414

### **SCIENTIFIC AIDES**

#### **Chico**

Will Castillo - (530) 774-7377 william.castillo@wildlife.ca.gov  
Andrew Coloma - (541) 580-9185 andrew.coloma@wildlife.ca.gov  
Justin Fairchild - (918) 398-3168 justin.fairchild@wildlife.ca.gov  
Grant Henley - (530) 521-0810 grantton.henley@wildlife.ca.gov  
Nate Maroon – (707) 319-9115 nathan.maroon@wildlife.ca.gov  
Kevin Moncrief - (408) 859-0521 kevin.moncrief@wildlife.ca.gov  
Matt Rogers - (530) 680-1261 matthew.rogers@wildlife.ca.gov  
Tommy Steele - (530) 520-3624 thomas.steele@wildlife.ca.gov  
Michael Williams - (530) 680-9216 michael.williams@wildlife.ca.gov

#### **Rancho Cordova**

Tho (Kenny) Tran - (916) 588-5657 tho.tran@wildlife.ca.gov  
Kari Gahan - (775) 225-0464 kari.gahan@wildlife.ca.gov  
Michael Gillingham - 865-850-6407 michael.gillingham@wildlife.ca.gov  
Daniel Martinez - 530-304-7477 daniel.martinez@wildlife.ca.gov  
Michelle Holtz - 818-815-8969 michelle.holtz@wildlife.ca.gov  
Josef Lehr - (530) 919-8649 josef.lehr@wildlife.ca.gov  
Shig Kubo – (209) 352-1604 hideaki.kubo@wildlife.ca.gov  
Kari McClanahan – (916) 531-0804 kari.mcclanahan@wildlife.ca.gov  
Brian Raleigh – (916) 505-9599 brian.raleigh@wildlife.ca.gov  
Michael Paccassi – (916) 303-3691 michael.paccassi@wildlife.ca.gov  
Chad Richardson – (916) 307-8302 chad.richardson@wildlife.ca.gov  
Lee Duckwall – (831) 454-6044 lee.duckwall@wildlife.ca.gov  
Skyler Burson -- (916) 223-4602 skyler.burson@wildlife.ca.gov  
Marguax McClure – (916) 247-1349 marguax.mcclure@wildlife.ca.gov

### **MISCELLANEOUS**

Region 2 Main Office – (916) 358-2900 fax- (916) 358-2912  
Sutter Mutual Yard (Tisdale boat storage) – (530) 632-4803  
Jerry Rose (Knights Landing dock owner) - cell: (530) 681-9221

### **EMERGENCY AND LAW ENFORCEMENT**

DFG Warden Dispatch – (916) 445-0045  
Lt. Jeff Longwell (Rancho Cordova) - (916) 425-9043  
Tim Bolla (Yolo County Warden) – (530) 604-9788  
Lt. Sam Castillo (Chico) – (530) 895-4240  
Cal Tip (report poaching and pollution) – (888) 334-2258  
California Highway Patrol Dispatch – (916) 861-1299  
Colusa County Sheriff Dispatch – (530) 458-0200

Sacramento County Sheriff Dispatch - (916) 874-5155  
Sacramento City Police - (916) 264-5471  
Sacramento County Parks Dispatch - (916) 875-6672  
Yolo County Sheriff Dispatch - (530) 666-8282  
Sutter County Sheriff Dispatch - (530) 822-7307  
Glenn County Sheriff Dispatch – (530) 934-6441  
Butte County Sheriff Dispatch – (530) 538-7321

**Appendix C.** The Department's Analysis on the Potential for Chinook Salmon Passage at the Knights Landing Outfall Gates

**Assessment of the Colusa Basin Drain Gate Structure at Knights Landing  
for Potential Passage of Adult Chinook Salmon from the  
Sacramento River into the Colusa Basin Drain**

George Heise – CDFW

June 21, 2013

This write up describes the conditions and criteria that were used to evaluate the potential for adult Chinook salmon to pass through the subject structure from the Sacramento River into the Colusa Basin Drain (CBD). It provides minimal background and assumes the reader is familiar with the CBD gate structure and the issues of concern.

The CBD gate structure regulates flow from the CBD to the Sacramento River near Knights Landing. The structure consists of a concrete barrier wall the CBD canal with 10 round gated openings to regulate flow. Eight of the openings are 66 inches in diameter and two are 42 inches in diameter. All have a centerline elevation of 21.0 feet and are equipped with a slide gate on the upstream (canal) side and a flap gate on the downstream (river) side. The slide gates allow the water level in the canal to be regulated at an elevation above the river level. The flap gates prevent water from the river passing into the canal when the river is higher than the water level in the canal. The gate structure has concrete slab at elevation 17.0 extending downstream of the gate openings for a distance of about 40 feet, more or less, to prevent bed erosion from the discharge through the gates.

The potential for fish passage through the structure was evaluated based on two criteria: downstream water elevation providing sufficient depth over the slab, and; the maximum theoretical water velocity through the gates as determined by the water elevation differential across the structure (head).

At a river elevation of 20 feet, there would be 3 feet of water over the slab and the bottom of the gate opening (el. 18.25) would be submerged by 1.75 feet. This condition was assumed to facilitate passage of fish through the gate openings. As the downstream water level drops, it was assumed that fish passage would be increasingly impaired. When the d/s water level drops below 19 feet, the depth over the slab becomes less than two feet and the back water depth on the gates is minimal. When combined with high discharge velocity, downstream water elevations below 19 feet were considered to block passage.

The burst swim speed for adult Chinook salmon is from 10.8 to 22.4 fps (Bell 1991.) Using the relationship between maximum water velocity vs. head, a water differential across the gate structure of 6 feet will develop a velocity of 20 fps, 4 feet will develop 16 fps, 2 feet will develop 11 fps and 1 foot head will develop 8 fps in the discharge stream. For this evaluation, it was assumed that a head differential less than 4 feet would facilitate passage; 4 feet to 6 feet would impair passage, and above 6 feet would block passage.

Combining the two criteria, the following “Traffic Light” rating was used to evaluate passage potential:

- Green: Passage likely
  - D/S water elevation above 20’ and head differential less than 4’.
- Yellow: Passage impaired
  - D/S water elevation between 19’ and 20’ and head differential less than 6’, or,
  - D/S water elevation above 19’ and head differential between 4’ and 6’.
- Red: Passage blocked
  - D/S water elevation below 19’ and/or head differential greater than 6’.

Provisional gauge data was provided by DWR for the water levels in the CBD above the gate structure and the Sacramento River at Knights Landing (which is used for the downstream water elevation at the gate structure) for the period from January 1, 2013 to April 24, 2013. This data was entered into a spreadsheet (file name: Colusa Drain Gate Head Differential - 1-1-13 to 4-24-13.xlsx) and rated according to the criteria above. The results were as follows:

- |                       |          |                          |
|-----------------------|----------|--------------------------|
| • 1/01/13 to 1/19/13, | 19 days, | Green: Passage likely    |
| • 1/20/13 to 2/02/13, | 14 days, | Yellow: Passage impaired |
| • 2/03/13 to 2/06/13, | 4 days,  | Green: Passage likely    |
| • 2/07/13 to 2/13/13, | 7 days,  | Yellow: Passage impaired |
| • 2/14/13 to 4/02/13, | 24 days, | Red: Passage blocked     |
| • 4/03/13 to 4/14/13, | 12 days, | Yellow: Passage impaired |
| • 4/15/13 to 4/24/13, | 10 days, | Red: Passage blocked     |
| • End data            |          |                          |

The daily values for water levels, head differential and passage rating can be seen on the spreadsheet noted above. Note that other factors affecting fish passage such as attraction flow, fish presence, gate operations or fish condition were not considered in this fish passage potential assessment.



Water Elevation at Colusa Basin Drain Gates at Knights Landing													
Green:	D/S > 20'	and	H < 4'	Yellow:	19' < D/S < 20'	and	H < 6'	Red:	D/S < 19'	and/or	H > 6'		
Date/Time	Upstream	Downstream	Head		19' < D/S	and	4' < H < 6'						
1/1/13	30.9	29.8	1.1	19 days	2/14/13	25.1	19.0	6.1	24 days	4/3/13	25.0	20.3	4.7
1/2/13	29.9	28.0	1.9		2/15/13	24.9	18.6	6.3		4/4/13	25.1	20.3	4.8
1/3/13	28.9	26.5	2.4		2/16/13	24.9	18.4	6.5		4/5/13	25.0	20.2	4.8
1/4/13	27.9	25.5	2.4		2/17/13	24.9	18.3	6.6		4/6/13	25.0	19.9	5.1
1/5/13	26.4	24.5	1.8		2/18/13	24.7	18.3	6.4		4/7/13	25.0	20.1	4.9
1/6/13	25.2	23.7	1.5		2/19/13	24.5	18.3	6.3		4/8/13	25.0	20.6	4.4
1/7/13	24.6	23.2	1.5		2/20/13	24.4	18.3	6.1		4/9/13	25.1	20.8	4.3
1/8/13	24.8	23.0	1.8		2/21/13	24.2	18.2	6.0		4/10/13	25.2	20.5	4.6
1/9/13	24.4	22.7	1.7		2/22/13	24.3	18.2	6.1		4/11/13	25.0	20.3	4.7
1/10/13	24.4	22.6	1.8		2/23/13	24.2	18.1	6.1		4/12/13	25.1	19.8	5.3
1/11/13	24.4	22.5	1.9		2/24/13	24.3	18.1	6.2		4/13/13	24.9	19.4	5.6
1/12/13	24.1	22.4	1.8		2/25/13	24.3	17.8	6.4		4/14/13	25.0	19.0	6.0
1/13/13	23.9	22.2	1.6		2/26/13	24.1	17.7	6.4		4/15/13	25.0	18.7	6.4
1/14/13	23.4	21.9	1.5		2/27/13	23.9	17.7	6.3		4/16/13	25.0	18.2	6.7
1/15/13	23.3	21.5	1.7		2/28/13	23.8	17.6	6.3		4/17/13	25.2	17.3	7.8
1/16/13	23.2	21.2	2.1		3/1/13	23.6	17.5	6.2		4/18/13	25.0	16.9	8.2
1/17/13	23.7	20.9	2.8		3/2/13	23.6	17.4	6.2		4/19/13	24.9	16.2	8.7
1/18/13	24.3	20.6	3.7		3/3/13	23.8	17.2	6.6		4/20/13	24.7	15.4	9.2
1/19/13	24.5	20.4	4.0	14 days	3/4/13	23.8	17.3	6.5		4/21/13	24.2	15.0	9.2
1/20/13	24.4	20.1	4.4		3/5/13	23.7	17.3	6.5		4/22/13	24.3	14.6	9.7
1/21/13	24.3	19.9	4.4		3/6/13	23.7	17.2	6.5		4/23/13	24.5	14.3	10.2
1/22/13	24.1	19.9	4.3		3/7/13	23.7	17.4	6.4		4/24/13	24.7	14.0	10.6
1/23/13	24.1	19.9	4.2		3/8/13	23.6	17.5	6.1					
1/24/13	24.6	19.8	4.9		3/9/13	23.6	17.5	6.1					
1/25/13	25.1	19.9	5.2		3/10/13	23.8	17.4	6.4					
1/26/13	25.7	20.3	5.4		3/11/13	23.8	17.7	6.2					
1/27/13	25.8	21.4	4.4		3/12/13	23.9	18.1	5.8					
1/28/13	25.7	21.5	4.1		3/13/13	23.9	18.4	5.5					
1/29/13	25.7	21.5	4.1		3/14/13	23.9	18.3	5.6					
1/30/13	26.3	21.4	4.9		3/15/13	24.5	18.1	6.3					
1/31/13	25.4	21.3	4.2		3/16/13	25.2	18.2	6.9					
2/1/13	25.1	21.0	4.1		3/17/13	25.1	18.5	6.6					
2/2/13	25.1	20.8	4.3	4 days	3/18/13	25.1	18.7	6.4					
2/3/13	24.4	20.8	3.6		3/19/13	25.0	18.7	6.3					
2/4/13	24.4	20.5	3.9		3/20/13	25.0	18.2	6.8					
2/5/13	24.5	20.4	4.0		3/21/13	25.1	18.0	7.2					
2/6/13	24.4	20.7	3.8	7 days	3/22/13	25.1	18.2	6.9					
2/7/13	25.1	20.3	4.8		3/23/13	24.9	18.8	6.2					
2/8/13	25.0	20.3	4.7		3/24/13	25.0	18.6	6.4					
2/9/13	25.0	20.0	5.0		3/25/13	25.1	18.2	6.9					
2/10/13	25.0	20.0	5.0		3/26/13	25.2	17.8	7.3					
2/11/13	25.0	19.9	5.1		3/27/13	25.0	17.8	7.3					
2/12/13	25.0	19.6	5.4		3/28/13	24.9	17.5	7.4					
2/13/13	25.1	19.4	5.8		3/29/13	24.9	17.1	7.8					
					3/30/13	24.8	17.1	7.8					
					3/31/13	25.0	16.9	8.1					
					4/1/13	25.1	17.8	7.3					
					4/2/13	25.1	18.9	6.2					

## Appendix D: Fish Rescue Permit

Section 10 Permit 18181  
151422SWR2013SA00270

### ENDANGERED SPECIES ACT SECTION 10(a)(1)(A) PERMIT FOR DIRECT TAKE OF LISTED SPECIES FOR SCIENTIFIC RESEARCH AND ENHANCEMENT PURPOSES

**Permit Number:** 18181  
**Permit Type:** Scientific Research and Enhancement  
**Expiration Date:** December 31, 2018  
**Reporting Period:** January 1 through December 31, annually  
**Annual Reports Due:** March 1, annually  
**Final Report Due:** April 1, 2019

Permit Holder:  
California Department of Fish and Wildlife, Region II  
1701 Nimbus Road, Suite A  
Rancho Cordova, CA 95670  
Phone: (916) 358-2900

Responsible Party:  
Tina Bartlett  
Regional Manager  
California Department of Fish and Wildlife  
1701 Nimbus Road, Suite A  
Rancho Cordova, CA 95670  
**Phone:** (916) 358-2943  
**Email:** tina.bartlett@wildlife.ca.gov

Primary Contact and Principal Investigator:  
Christian McKibbin  
Environmental Scientist  
California Department of Fish and Wildlife  
1701 Nimbus Road, Suite A  
Rancho Cordova, CA 95670  
**Phone:** (916) 358-2933  
**Email:** Chris.McKibbin@wildlife.ca.gov

Co-Investigators:  
Jason Julianne  
Tom Schroyer

#### Authorization:

This authorization is subject to the provisions of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531-1543) as amended, the National Marine Fisheries Service (NMFS) regulations governing ESA-listed species permits (50 CFR Parts 222-226), and the conditions set forth hereinafter.

CDFW is hereby authorized to take adult ESA-listed Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley spring-run Chinook salmon (*O. tshawytscha*), California Central Valley steelhead (*O. mykiss*) and adult, subadult, and juvenile Southern distinct population segment of North American (SDPS) green sturgeon (*Acipenser medirostris*) associated with rescue activities and scientific research in the Colusa Basin Drainage Canal (CBDC), Wallace and Fremont weirs in the Yolo Bypass and Tisdale Weir in the Sutter Bypass, as cited in the permit holder's application. Take numbers are listed by category in Tables 1-3 of this permit.

Background:

**Fish Rescues in the CBDC**

In April 2013, U.S. Fish and Wildlife Service (USFWS) personnel at the Sacramento National Wildlife Refuge reported seeing a large number of adult salmon trapped behind a diversion (Dam 1) in North Logan Creek in the Refuge. CDFW personnel verified that they were Chinook salmon and a rescue operation was carried out from May 2 – 31 with a total of 312 Chinook salmon placed back in the Sacramento River or taken to Livingston Stone National Fish Hatchery (LSNFH). The discovery of hundreds of adult Chinook salmon, both winter-run and spring-run, that had strayed into this system of canals and waterways prompted speculation on points of entry, barriers and possible routes of return for these fish. Though over 300 Chinook salmon were rescued, many more were seen but not rescued; therefore it is unknown how many perished in the canal. The magnitude of this occurrence annually is also unknown, but with extremely low numbers of winter-run returning to the Sacramento River to spawn in recent years, entrainment in the canals is likely having a significant negative effect on the recovery of this run.

This study aims to identify points of entry into the CBDC and track salmon movements through the system in order to pinpoint primary routes and increase efficiency of rescue efforts. The objectives described by CDFW are to:

- 1) Capture, tag and relocate Sacramento River winter-run Chinook salmon and other species of management concern in the lower reaches of the CBDC or at Wallace Weir within the Yolo Bypass to estimate the number of fish entering the CBDC.
- 2) Construct and place modified fyke traps at key locations within the interior of the CBDC system to capture, tag and relocate stranded fish if the weirs lower in the system are not successful at stopping fish.

In order to achieve the objectives stated above, the trapping site will consist of a resistance board weir guiding fish into a fyke trap. The latter portion of the trap will be of solid construction and will consist of two holding areas, one with a larger opening for adult sturgeon size fish and one with a smaller opening for adult salmon and steelhead size fish. The trap is designed to allow for the passage of juveniles and smaller species that may be present. The traps will be sampled continuously; 24 hours per day, 7 days per week. Once captured, all fish will be externally tagged with two colored and individually numbered Floy tags identifying its capture. Detailed information will be gathered pertaining to trapping conditions; number, size and species of fish

captured; type of tag and tag number received by individuals; and fish transport/release conditions.

*Recovery and Relocation*

Placement of a fish barrier/trap before the waterways branch would prevent fish from moving into the smaller tributaries and canals where they are difficult to locate and rescue. CDFW surveyed the lower CBDC in the summer of 2013 to identify suitable trapping locations. The primary site identified is located within the CBDC approximately 14 miles upstream from Knights Landing, California. This location has a small island in the middle of the CBDC that would be an ideal trapping location most of the year.

A barrier will be set up around the island at a slight angle across the waterway to funnel fish into a large trap set near the canal bank. The barrier will be an Alaskan-style resistance board weir. These weirs perform well with high debris loads and variable flows. Racks can be removed and a temporary barrier net put in place for cleaning of debris if needed. During periods of high flow, debris barriers will be placed upstream from the traps to deflect large woody debris for removal before impacting the traps. Weirs will be in place year-round and maintained by crews on a 24-hour basis depending on numbers of fish caught each day. Trapping operations may be discontinued in the summer months, depending on numbers of fish captured in the traps.

*Potential Rescue/Salvage of adult winter-run Chinook salmon*

During extreme high flood events, the weir and traps will be inoperable and removed. The barrier racks will be removed, stored on shore then reinstalled when conditions and water levels allow. During these events, fish of all species will have opportunity to move upstream unhampered by diversions or dams and move into the maze of waterways connected to the Colusa Drain. After these events, semi-permanent barriers and fyke traps will be installed upstream in key areas within the CBDC such as, but not limited to, the CBDC diversion structure at the juncture of Hunter Creek, under the 4 Mile Road Bridge and Dam 3 locations on Hunters Creek, Dam 1 at North Logan Creek, the confluence of Logan and North Logan Creeks, the confluence of Stone Corral Creek and Funks Creek, and the CBDC near the Delevan National Wildlife Refuge. CDFW discovered that fish strayed to these locations during the 2012/13 season. Each rescued Chinook salmon will receive an external individually-numbered Floy tag, placed in a 350-400 gallon fish transport truck and returned to the Sacramento River at Knights Landing or the nearest place for release.

### **Rescue of Fish Entrained behind Fremont and Tisdale Weirs**

During high flow events a significant proportion of the Sacramento River is diverted into the Sutter and Yolo Bypass through specific flood relief structures. Substantially more water can be passing through the bypasses than is in the river itself during these flood events. This dramatically alters not just the volume of water in the main channel but the variations in flow over time. Fish in the river downstream of these flood relief structures experience a drastically different flow regime than fish do upstream of these structures. This can affect immigration and emigration cues for anadromous fish. Adult fish migrating upstream may be attracted into the bypasses. Additionally, during high flows that overtop the flood relief structures (weirs), a large percentage of out-migrating fish in the river may be diverted into the bypass. As flows recede many of these fish can then become stranded in the bypasses. This has implications on detectability of fish moving past in-river monitoring sites and is of special concern when tracking movement of listed stocks. More importantly entrainment and stranding can result in significant mortality for fish including listed species. Past rescue efforts for stranded fish in the Sacramento Valley have been successful at saving stranded fish including SDPS green sturgeon. Rescue efforts provide an invaluable opportunity to save stranded fish while learning from them. Because each stranded individual would perish in the absence of intervention, data collection for this study can be viewed as information gathered from salvaged specimens (see description of Salvage Specimens in NOAA Tech Memo NMFS-OPR- 45, March 2010, pg. 48). It is crucial to identify the level of impact flood relief structures are having on populations of listed species and to identify whether stranded fish can successfully contribute to the population after being rescued. Information from this study has management implications for water project operations.

CDFW is proposing the following study in order to:

- 1) Monitor flood relief structures if environmental conditions (high flows, flooding) warrant and rescue fish entrained behind Fremont and Tisdale weirs.
- 2) Assess the level of entrainment and evaluate the survival and behavior of entrained adults that are rescued and relocated.
- 3) Identify conditions resulting in higher levels of entrainment specific to each location.

Both the Sutter and Yolo Bypass will be surveyed after high flow events with a specific focus on flood relief structures of the Sacramento River. Observations of entrained fish and past rescue efforts have occurred at both Tisdale and Fremont Weirs suggesting these locations to have a higher likelihood of entraining sturgeon during flood events. In this effort, flood relief structures will be monitored after high flow events throughout the Sacramento River. Block nets and hoop nets will be used to capture entrained adult sturgeon. Acoustic tags will be surgically implanted by trained department staff (training by UCD/USBR staff) and data will be recorded on fish size, condition, and time of release. Additionally, abiotic data will be recorded including river conditions prior to and during entrainment and the duration of entrainment will be calculated to the extent possible. After capture, adults will be held in a fish stretcher or cradle ventral side up. Gills will be continually irrigated with well-oxygenated water. Fish will then be quickly assessed for physical condition, acoustically tagged and Floy tagged. For surgical insertion of the

acoustic tag, a small incision (11 millimeters [mm] for VEMCO V9 tags) will be made between the third and fourth ventral scute, approximately 2-3mm off the ventral midline. The tag will be inserted into the peritoneal cavity and closed with a 4/0 PDSII absorbable suture. To help with external identification a photograph will be taken prior to release and fish will be externally tagged with two colored and individually numbered Floy tags. Genetic samples may also be taken from the anal fin. If any juvenile green sturgeon are captured during a rescue effort their presence will be documented and they will be transported immediately to the nearest release location in the river and released. No juvenile green sturgeon will be tagged.

If adult salmonids are found to be entrained, they will be captured using beach seines. Data collected will be similar to that described for sturgeon, however salmonids will not receive acoustic tags. They will receive two colored and individually numbered Floy tags and be sampled for tissues. After processing, fish will be transported to the closest accessible point on the Sacramento River to the rescue site. If this distance is less than 100 yards fish will be directly transported to the river using the stretcher. If this distance is greater than 100 yards then fish will be placed in a specialized holding tub with water and transported by truck to the nearest possible release location. Fish will not be anesthetized during the tagging process due to the need to then hold fish for 21 days after the use of Tricaine methanesulfonate (MS-222). Fish will then be released back into the Sacramento River at the nearest possible point to minimize transport times. Fish movement data will rely upon data collected by acoustic receivers deployed throughout the Central Valley, Delta, and San Francisco Bay.

Requested Amount of Take and Unintentional Mortality

Tables 1-3 document the total amount of requested annual take of ESA-listed salmonids and SDPS green sturgeon by CDFW associated with Permit 18181.

**Table 1.** Annual take of ESA-listed salmonids and SDPS green sturgeon within the Colusa Basin Drainage Canal authorized by Permit 18181 for CDFW.

**Waterbody Name:** Sacramento River/Colusa Basin Drainage Canal and Wallace Weir in the Yolo Bypass

**Location Description:** The trapping location will be within the CBDC which is fed through water diversions from the Sacramento River.

SPECIES	LISTING UNIT/STOCK	PRODUCTION/ORIGIN	LIFESTAGE	SEX	EXPECTED TAKE	INDIRECT MORTALITY	TAKE ACTION	OBSERVE/COLLECT METHOD	PROCEDURES
Salmon, Chinook	Sacramento River winter-run (NMFS Endangered)	Natural	Adult	Male and Female	700	35	Collect and Transport Live Animal	Weir (only if associated with fish handling)	Tag, Floy, Tissue Sample Fin or Opercle
Salmon, Chinook	Sacramento River winter-run (NMFS Endangered)	Listed Hatchery Adipose Clip	Adult	Male and Female	450	20	Collect and Transport Live Animal	Weir (only if associated with fish handling)	Tag, Floy, Tissue Sample Fin or Opercle
Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Adult	Male and Female	500	25	Collect and Transport Live Animal	Weir (only if associated with fish handling)	Tag, Floy, Tissue Sample Fin or Opercle
Steelhead	California Central Valley (NMFS Threatened)	Natural	Adult	Male and Female	200	10	Collect and Transport Live Animal	Weir (only if associated with fish handling)	Tag, Floy, Tissue Sample Fin or Opercle
Steelhead	California Central Valley (NMFS Threatened)	Listed Hatchery Adipose Clip	Adult	Male and Female	200	10	Collect and Transport Live Animal	Weir (only if associated with fish handling)	Tag, Floy, Tissue Sample Fin or Opercle
Sturgeon, green	Southern DPS (NMFS Threatened)	Natural	Adult	Male and Female	25	1	Collect and Transport Live Animal	Weir (only if associated with fish handling)	Tag, Floy, Tissue Sample Fin or Opercle

**Table 2.** Annual take of ESA-listed salmonids and SDPS green sturgeon within the Colusa Basin Drainage Canal authorized by Permit 18181 for CDFW.



**Waterbody Name:** Colusa Basin Drainage Canal

**Location Description:** Rescue/Salvage within the CBDC should fish pass through the resistance board weir (flood events, etc.). Trapping will occur at key areas within the CBDC.

SPECIES	LISTING UNIT/ STOCK	PRODUCTION/ ORIGIN	LIFESTAGE	SEX	EXPECTED TAKE	INDIRECT MORTALITY	TAKE ACTION	OBSERVE/ COLLECT METHOD	PROCEDURES	DETAILS
Salmon, Chinook	Sacramento River winter-run (NMFS Endangered)	Natural	Adult	Male and Female	300	30	Collect and Transport Live Animal	Trap, Not listed here	Tag, Floy; Tissue Sample Fin or Opercle	Fish will be captured using semi-permanent barriers and fyke traps.
Salmon, Chinook	Sacramento River winter-run (NMFS Endangered)	Listed Hatchery Adipose Clip	Adult	Male and Female	250	25	Collect and Transport Live Animal	Trap, Not listed here	Tag, Floy; Tissue Sample Fin or Opercle	Fish will be captured using semi-permanent barriers and fyke traps.
Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Adult	Male and Female	250	25	Collect and Transport Live Animal	Trap, Not listed here	Tag, Floy; Tissue Sample Fin or Opercle	Fish will be captured using semi-permanent barriers and fyke traps.
Salmon, Chinook	Sacramento River winter-run (NMFS Endangered)	Natural	Spawned Adult/ Carcass	Male and Female	20	0	Observe/Sample Tissue Dead Animal	Trap, Not listed here	Tissue Sample Fin or Opercle	Fish will be captured using semi-permanent barriers and fyke traps.
Salmon, Chinook	Sacramento River winter-run (NMFS Endangered)	Listed Hatchery Adipose Clip	Spawned Adult/ Carcass	Male and Female	20	0	Observe/Sample Tissue Dead Animal	Trap, Not listed here	Tissue Sample Fin or Opercle	Fish will be captured using semi-permanent barriers and fyke traps.
Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Spawned Adult/ Carcass	Male and Female	15	0	Observe/Sample Tissue Dead Animal	Trap, Not listed here	Tissue Sample Fin or Opercle	Fish will be captured using semi-permanent barriers and fyke traps.

**Table 3.** Annual take of ESA-listed salmonids and SDPS green sturgeon at Sacramento River Flood Control Project Weirs and Flood Relief Structures authorized by Permit 18181 for CDFW.

**Waterbody Name:** Sacramento River - Tisdale Weir in the Sutter Bypass and Fremont Weir in the Yolo Bypass  
**Location Description** Sutter and Yolo bypasses will be surveyed after high flow events with a specific focus on Fremont and Tisdale weirs on the Sacramento River.

SPECIES	LISTING UNIT/STOCK	PRODUCTION/ORIGIN	LIFESTAGE	SEX	EXPECTED TAKE	INDIRECT MORTALITY	TAKE ACTION	OBSERVE/COLLECT METHOD	PROCEDURES
Sturgeon, green	Southern DPS (NMFS Threatened)	Natural	Adult	Male and Female	35	0	Capture/Mark, Tag, Sample Tissue/Release Live Animal	Net, Hoop	Tag, Acoustic or Sonic (Internal); Tag, Floy; Tissue Sample Fin or Opercle
Sturgeon, green	Southern DPS (NMFS Threatened)	Natural	Subadult	Male and Female	15	0	Capture/Mark, Tag, Sample Tissue/Release Live Animal	Net, Hoop	Tag, Acoustic or Sonic (Internal); Tag, Floy; Tissue Sample Fin or Opercle
Sturgeon, green	Southern DPS (NMFS Threatened)	Natural	Juvenile	Male and Female	10	0	Capture/Handle/Release Live Animal	Net, Hoop	
Salmon, Chinook	Sacramento River winter-run (NMFS Endangered)	Natural	Adult	Male and Female	25	0	Capture/Mark, Tag, Sample Tissue/Release Live Animal	Seine, Beach	Tag, Floy; Tissue Sample Fin or Opercle
Salmon, Chinook	Sacramento River winter-run (NMFS Endangered)	Listed Hatchery Adipose Clip	Adult	Male and Female	25	0	Capture/Mark, Tag, Sample Tissue/Release Live Animal	Seine, Beach	Tag, Floy; Tissue Sample Fin or Opercle
Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Adult	Male and Female	25	0	Capture/Mark, Tag, Sample Tissue/Release Live Animal	Seine, Beach	Tag, Floy; Tissue Sample Fin or Opercle
Steelhead	California Central Valley (NMFS Threatened)	Natural	Adult	Male and Female	20	0	Capture/Mark, Tag, Sample Tissue/Release Live Animal	Seine, Beach	Tag, Floy; Tissue Sample Fin or Opercle

## Appendix E. Equipment Check List

Equipment List for DIDSON Fish Monitoring	
• DIDSON monitoring study plan	•
• DIDSON unit (pelican case)	•
• DIDSON cable (60 meter cable)	• Data Sheets
• DIDSON power inverter and power cable	•
• Field laptop and power cable	•
•	• Field Notebook
• Clipboards	• Polarized Sunglasses
• Pens, Pencils, Sharpies (permanent marker)	•
• Tool box	• Swift Water Safety Gear
•	• First Aid Kit and throw rope
• Dry Cloth (to dry off equipment, etc.)	•
• Cellular or satellite phone	• Digital Camera
• Contact and emergency phone numbers	•
• GPS unit	•
• Extra Batteries for GPS	•
•	•
• Waders, dry suits and wading boots	•
• Sun Block	•
•	•
• Project personal contact list	• Head-tags and bags in case carcass is observed
• Generator (Honda 1000)	• Electrical extension cords

## Appendix F. DIDSON monitoring fish rescue daily datasheet



### Colusa Basin Drain DIDSON SONAR MONITORING AND FISH RESCUE PROJECT 2015

Field Crew: \_\_\_\_\_

Date: \_\_\_\_\_

Site Name: \_\_\_\_\_

GPS Waypoint: \_\_\_\_\_

Weather: \_\_\_\_\_

Visual Survey: (Circle One: From Shore or Snorkel)

Start (hh:mm): \_\_\_\_ : \_\_\_\_ Stop (hh:mm): \_\_\_\_ : \_\_\_\_

Notes: \_\_\_\_\_

DIDSON Survey:

Start (hh:mm): \_\_\_\_ : \_\_\_\_ Stop (hh:mm): \_\_\_\_ : \_\_\_\_

Notes: \_\_\_\_\_

Conditions:

Flow Velocity Taken: \_\_\_\_ Yes \_\_\_\_ No (Check One). Measure only if conditions are safe.

Flow Velocity (ft/s): \_\_\_\_\_

Time: \_\_\_\_\_ Temperature: \_\_\_\_\_ (C or F)

Water Sample Taken: \_\_\_\_\_ (1=yes, 0=no)

Secchi: \_\_\_\_\_ Ave: \_\_\_\_\_ (Measured to nearest 0.1 ft at disappearance and reappearance)

Turbidity (NTU): \_\_\_\_\_

Debris: \_\_\_\_\_  
(Low, Medium, High)

Additional Notes: \_\_\_\_\_

#### 1. Focal Species Observed

Species	Total
Chinook Salmon	
Steelhead	
Green Sturgeon	
White Sturgeon	

#### 2. Non-Target Species Observed

Species	Total

#### 3. Carcasses Observed

Common Name	Total

## Appendix G: Tissue collection catalogue and storage protocol

- I. Select a fresh carcass suitable to obtain a tissue sample. A fresh carcass will have clear eyes (not cloudy) and/or pink gills. **Record all data on the coin envelope.** Use only one envelope per fish. If the envelope is not pre-stamped, include the following data: date, location with landmarks, sample ID number, GPS coordinates (if available), fork length (mm), sex of fish, collector's name, fin which sample was taken from, species of fish, adipose fin present or absent, and any other information pertaining to the sample.
- II. From each fish, choose a fin (caudal, pectoral, dorsal, etc.) in the best condition. Take a fin-clip (size indicated in Figure 1) from the base of the fin (Figure 2). Do not take tissue from the adipose fin as there is little DNA provided in that sample.
- III. Place the tissue sample on one piece of filter paper and fold paper over to cover the sample. Place filter paper into the coin envelope.
- IV. Vigorously agitate scissors in water between samples to prevent cross contamination.
- V. Cut open each fish and examine the gonad tissue to confirm the sex of the fish. Write any remarks concerning the sample in the notes section of the data sheet (e.g. the fish looks like a male, but has female gonads)
- VI. Either in the field after collection, or in the office immediately upon return from the field, air-dry all samples on the same filter paper. The samples are dry when all mucous and moisture has evaporated and the tissue feels dry to the touch. Sun drying in the field works best and can be done quickly. Drying fins indoors usually takes 24 hours.
- VII. Record the appropriate field and lab preservation methods (both will normally be noted in the "other" column as "air dried") on the data sheet.
- VIII. When completely dry, repackage tissue into its original, dry, envelope and attach to field notes for shipment to our lab. Please make arrangements with the Tissue Archive before shipping. Check all envelopes to ensure that the data is filled out completely and legibly.

